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Individual Learning Plan in Teaching Mathematics for Children with SEN – a Constructivist Approach

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Abstract

This paper focuses on the description of the role of the individual learning plan for children with difficulties in Mathematics, plans which are used in a constructivist approach. In this case, the teacher's role is very important. The teacher must blend the adequate strategies for each student with the cooperative learning strategies. As showed in the case study, students who benefit from individual learning plans in a constructivist approach can improve their mathematical skills. Teachers who taught Mathematics in a constructivist approach which embraces elements of discovery, situated learning, cooperation and use an individual learning plan obtained good results with their students and developed their social skills.

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Keywords: individual learning plan, mathematical difficulties, constructivist approach

1. Introduction

The role of Mathematics in the national curriculum in every country is a very important one, justified through the skills it aims to form:" development of concentration, art of economical living, power of expression, self-reliance, attitude of discovery, understanding of popular literature, quality of hard work. "(Sidhu, 2006, p. 13)" We use mathematical operations every day. We need mathematical skills for all activities. A lot of researchers Piaget, Vîgotski (Mooney, 2013) underline the role of Matematics in cognitiv development. But learning Mathematics is not easy! Most of normal children have difficulties and do not experience success in this area.

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Students with learning difficulties are predisposed to mathematical disabilities. In this case, the teacher's role is very important. The teacher must blend the adequate strategies for each student with the cooperative learning strategies. P. Westwood underlines:" The teacher's role is to create a learning environment where there are abundant opportunities for active participation by students, and also to impart relevant information andteach specific skills and strategies". (2004,p.117)

1.1. Mathematics learning difficulties - a critical analysis

A review of the specialty literature reveals the follow questions posed about mathematical difficulties:

- What are the main mathematical difficulties?
- What are the main criteria to identify mathematical difficulties?
- What is the ratio of students (male/female) with mathematical difficulties?
- What can the teacher do to help students with mathematical difficulties (which are the adequate pedagogical strategies, which are the proper methods for learning mathematics, which are good learning styles and teacher communication styles, etc.)?

For the first and the second questions, the answer can be found in a study of a group of researchers (Stock, Desoete, Roeyers, 2006) who studied the literature and identified a lot of terms used when speaking about mathematical difficulties: dyscalculia, acalculia, mathematical disabilities, Mathematics learning problems, Mathematics learning disability. This variety of definitions has created confusion in this field of learning difficulties. The authors propose the use of four subtypes of mathematical disabilities which "are currently found in scientific research: the subtypes based on procedural deficits, semantic memory deficits, visuospatial deficits and number knowledge deficits" (2006, p.38).

Table 1: Subtypes in mathematical disabilities: description of terminology and distinguishing features, Stock, Desoete, Roeyers. 2006, pp.44-45

Subtype	Used terminology	Characteristic Features
Procedural deficits	Anaritmetria *(Hécaen, Angelergues and Huillier, 1961)* Operational dyscalculia*(Kosc, 1974)* Spatial dyscalculia *(Badian, 1983)* Verbal developmental dyscalculia *(von Aster, 2000)* Procedural subtype *(Cornoldi and Lucangeli, 2004)* Procedural subtype *Geary (2004)*	Difficulties with procedures in (written) calculation Difficulties in sequencing multiple steps in complex procedures Difficulties in planning or execution of complex arithmetic operations Difficulties in mental calculations Difficulties in routines Use of immature strategies Many mistakes in execution of complex procedures Time-lag in arithmetic procedures Poor understanding of concepts in procedures Semantic memory deficits
Semantic memory deficits	R-S profile *(Rourke, 1995)* Verbal developmental dyscaculia *(von Aster, 2000)* Disabilities in mental and automatized calculation *(Cornoldi et al., 2002)* Semantic memory deficits *(Geary, 2004)* Verbal dyscalculia *(Njiokiktjien, 2004)*	Difficulties in retrieval of numerical facts Disabled acquisition of number-fact knowledge Difficulties in the semantic-acoustic aspect of the linguistic domain Lower accuracy in mental calculation Slower speed of mental and written calculation Irregular reaction times Lower enumeration speed for figures, symbols, numbers and quantities High error rate Wrong associations in retrieval Difficulties in conceptual knowledge assignments Difficulties in language comprehension Difficulties with passive vocabulary Difficulties with orally presented assignments
Visuospatial deficits	Visuospatial deficits *(Hécaen et al., 1961)* Practognostic dyscalculia *(Kosc, 1974)*	Difficulties in situating numbers on a number line Disturbance in setting out objects in order according to magnitude Inversions and reversals in numbers

	Spatial dyscalculia *(Badian, 1983)* part of Numerical dyssymbolics *(Njiokiktjien, 2004)* Nonverbal learning disorder *(Rourke, 1995)* Visuospatial learning disability *(Lucangeli and Bellina, 2002)* Arabic dyscalculia *(von Aster, 2000)* Visuospatial subtype *(Geary, 2004)*	Misalignment and misplacements of digits Problems in symbol recognition Disturbance in visuospatial memory Difficulties in understanding geometry Misinterpretation of spatially represented information Nonverbal deficits Problems with insight in and notions of space Difficulties with abstraction Disturbance in visual imaginative faculty Disturbance in enumerating groups of objects Disturbance in estimating and comparing quantities Difficulties in the temporal order or planning Difficulties with novel and complex tasks Visual neglect Eventually dyspraxia
Number knowledge deficits	Aphasic acalculia *(Hécaen et al. 1961)* Verbal dyscalculia, Lexical dyscalculia and Graphical dyscalculia, Ideognostic dyscalculia *(Kosc, 1974)* Ideognostic dyscalculia *(Njiokiktjien, 2004)* Difficulties in number knowledge *(Cornoldi et al., 2004)* Arabic dyscalculia, Pervasive dyscalculia *(von Aster, 2000)*	Difficulties in comprehension of Arabic notational system, mathematical ideas and relations Difficulties with abstract number comprehension Disturbance in number knowledge Disturbances in basic sense of numerosity Disturbance of encoding the semantics of numbers Difficulties in transcoding between the different modalities Disturbance in number reading Disturbance in number writing Disturbance in number production Difficulties in size comparison Difficulties in number ordening Difficulties in enumeration Difficulties in number dictation

The table above shows two important findings:

a. the diversity of mathematical difficulties which can appear and hence the necessity of a personalized approach of these difficulties
b. the necessity of using several criteria for differentiating these difficulties in order to facilitate remedy and perhaps to prevent certain mathematical difficulties.

1.2. Individual learning plan through a constructivist approach

We emphasize once again the need for individualized treatment of mathematical difficulties, because of the importance of mathematical skills in children's cognitive development. Although at the beginning of schooling children have a strong interest in Mathematics, as revealed in another research conducted, slowly, over the school years, the interest in Mathematics decreases more and more. Another research (Voinea & Purcaru, 2013), conducted by us, has led to the following conclusions: student interest in Mathematics, as a general trend, has natural "sinusoidal" dynamics: there is a strong interest in Mathematics in primary school, which increases gradually, starting in preschool, with little decrease to the end of primary school.

One of the explanations for the decline in interest towards learning Mathematics is the emergence of various types of learning difficulties, producing a range of negative emotions - failure, frustrations, fears that lead to the formation of negative attitudes towards Maths in general.

One solution to this situation is the individualized learning plan, focused on the specific difficulty that the student shows, but applied in a constructivist approach. Current reforms in education are based on the socio-constructivist theories of learning, which promote skills for solving real-life problems. Even students with learning difficulties can solve real-life problems if the teacher uses an individual learning plan. The individual learning plan which is used in a constructivist approach is a solution for children with learning difficulties.

Many studies (Westwood, 2004; 2008) demonstrated that students develop mathematical skills most effectively in the classrooms where teachers have an academic focus, use challenging activities, have high expectations of students (including lower achievers) and use an individual learning plan.

2. Objectives and Hypotheses

3.1. Objectives

The main purpose of this study is to investigate the role of the individual learning plan for children with mathematical difficulties, while the plan is used in a constructivist approach. We presumed that a constructivist individual learning plan will increase the performance of math for children with learning mathematical difficulties.

3. Research Methods

This research, of an ascertaining-ameliorative nature, lasted for one school year at a school in an urban primary school where there were identified children with mathematical difficulties.

We used three case studies (two boys and a girl) from three primary school grades (students in III and IV grades, with dyscalculia), the study of school documents (student portfolio, individualized learning plans), participant observation and conversations with class teachers.

4. Results

In the first phase of our research, based on conversations with the primary school teachers, the most frequently encountered difficulties in learning mathematics were identified. The result was that dyscalculia is one of the most common difficulties, being met in 90% of students with satisfactory results in mathematics.

From the students with dyscalculia, there were selected three students - two in the third grade (a girl and a boy) and one in the fourth grade (boy), individualized learning plans have been developed for each of them and then, they were observed along the academic year, based on a scale of observation of their behaviour.

The individualized learning plan aimed at developing mathematical computation skills and the learning activities were designed according to the student's learning style by combining individual learning methods with interactive methods.

Thus, for one of the students in the III grade, B.M., with dyscalculia, with a normal mental development for a 9 year-old, but shy, showing great uncertainty in Mathematics, which has as auditory dominant learning style, we used the “Mosaic” method. The objective was to develop the ability of mathematical calculus and to develop self-confidence and overcome shyness.

By using the “Mosaic” method, the student B.M. had “to teach” his group of peers the calculation of simple exercises. At the same time, he received explanations from his colleagues and they solved the exercises together. After this stage of exercising in group, B.M. practiced individually. Gradually, the exercises were complicated, but B.M. managed to solve them with his colleagues’ help, and then practiced individually the same type of exercises.

We mention that the class teacher carefully set up a learning group in which B.M. would experience success, feel safe, communicate with colleagues if he did not understand or even made mistakes. This group was maintained until B.M. managed to calculate correctly (simple exercises) and to become more self-confident. Then, one member of the group changed and B.M. started working more and more with other groups. The teacher intervened discreetly in monitoring students in the group and recorded student behaviour on the observation scale.

With the student F.N., also in the III grade, with dyscalculia, with normal development, aged 9, female, sociable, having a visual learning style, we used the “Tour of the gallery” method. As in the previous case, the student was part of a learning group, carefully selected to offer her the possibility to experience success in solving mathematical calculation exercises. After solving exercises in the group, on a special hand-out, the hand-outs were displayed on the walls of the classroom and the group leader (among which was F.N., too) explained the way of solving them.

Another method used with a student in the IV grade, G.V. (who had difficulties in solving problems, an attention deficit, and was isolated from the other students in the class) was the “I know - I want to know - I have discovered" method, used to solve problems. The method used was adapted to G.V.'s psychical and individual features. First they worked in pairs, then in groups of four.

The observation method showed that the use of an individualized learning plan, in an interactive way, will not only unlock Mathematics learning and overcome difficulties, but it will also simultaneously increases self-confidence, communicative abilities, the ability to establish proper relationships with colleagues. The most notable result, however, is the progress in Mathematics by developing calculus skills that offer the possibility of solving many exercises correctly and obtain better results, as shown in the table below, where there are given comparative achievements in Mathematics in the initial, progressive and final evaluations for the students under observation.

Table 2. Results from students' evaluations after the implementation of the individualized learning plan

Pupils with dyscalculia	Initial assessment Correct exercises / Grade	Formative assessment Correct exercises / Grade					Final assessment Correct exercises / Grade
B.M. (III grade)	2/5- S	2/5-S	2/5-S	3/5- B	4/5-B	3/5-B	4/5-B
F.N. (III grade)	2/5-S	2/5-S	2/5-S	2/5-S	3/5- B	3/5- B	3/5- B
G.V. (IV grade)	1/5-S	2/5-S	3/5- B	3/5- B	3/5- B	3/5- B	3/5- B

Conversations with teachers from the three classes were focused on identifying the strengths and weaknesses of using an individualized learning plan. All three teachers highlighted the utility of using an individualized learning plan for students with learning difficulties, plan which lead to students' progress.

The weak points identified by teachers were: the large amount of time needed to design individual and group activities, the possibility of conflict arousal within the group of students, the need of continuity of this approach on long term (possibly on other educational levels, too), at school and at home.

5. Conclusions:

A limit of this study is: the power of generalization of the research conducted is low but, the case studies presented highlighted two important ideas:

Using individualized learning plans in a constructivist approach leads to overcoming certain learning difficulties. Learning, even if it is an individual process, cannot be taken out of the social context in which it is performed, and moreover, we should use the resources of the social context to increase an individual person's efficiency in learning. The fact that the students hear, see, experiment along with their peers increases their self-confidence.

The success in using individualized learning plans in a constructivist approach depends heavily on the teacher's competence. This competence is reflected not only in designing the individualized learning plan but also in its proper implementation (group formation, monitoring learning) and then assessing the pupils' progress.

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